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MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

Spectral Gamma-Ray Borehole
Log Data Report

Log Event A

Borehole # 50-03-05

Borehole Information

Farm : T	**Tank :** T-103	**Site Number :** 299-W10-117
N-Coord : 43,604	**W-Coord :** 75,796	**TOC Elevation :** 671.81
Water Level, ft : 122	**Date Drilled :** 7/31/1973	

Casing Record

Type : Steel-welded	Thickness, in. : 0.237	ID, in. : 4
Top Depth, ft. : 0	Bottom Depth, ft. : 123	
Type : Steel-welded	Thickness, in. : 0.280	ID, in. : 6
Top Depth, ft. : 0	Bottom Depth, ft. : 123	

Cement Bottom, ft. : 123 **Cement Top, ft. :** 0

Borehole Notes:

Borehole 50-03-05 was drilled in July 1973 to a depth of 91 ft with 6-in. casing. In March 1981, the borehole was deepened to 123 ft and the 6-in. casing was extended to the bottom of the borehole. The 6-in. casing was perforated from 0 to 20 ft and 80 to 123 ft. A 4-in. casing liner with a metal cap welded on the bottom was positioned inside the 6-in. casing. The entire annulus between the 4-in. and 6-in. casings was stemmed with 209 gal of grout. The thicknesses of the 4-in. and 6-in. casings are presumed to be 0.237 in. and 0.280 in., respectively, on the basis of the published thickness for schedule-40, 4-in. and 6-in. steel tubing.

Equipment Information

Logging System : 1B	**Detector Type :** HPGe	**Detector Efficiency:** 35.0 %
Calibration Date : 10/1997	**Calibration Reference :** GJO-HAN-20	**Logging Procedure :** MAC-VZCP 1.7.10-1

Logging Information

Log Run Number :	1	**Log Run Date :**	04/02/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	0.0	**Counting Time, sec.:**	200	**L/R :** L **Shield :**	N
Finish Depth, ft. :	42.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	2	**Log Run Date :**	04/03/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	41.0	**Counting Time, sec.:**	200	**L/R :** L **Shield :**	N
Finish Depth, ft. :	96.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

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Log Event A

Log Run Number :	3	**Log Run Date :**	04/06/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	122.5	**Counting Time, sec.:**	200	**L/R :** L	**Shield :** N
Finish Depth, ft. :	95.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	4	**Log Run Date :**	04/07/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	55.0	**Counting Time, sec.:**	200	**L/R :** L	**Shield :** N
Finish Depth, ft. :	40.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Logging Operation Notes:

This borehole was logged by the SGLS in four log runs using a 200-s counting time. Three of the log runs were required to log the length of the borehole. An additional log run was performed to repeat an interval of the borehole as a quality check. The top of the borehole casing, which is the zero reference for the SGLS, is approximately flush with the ground surface. The total logging depth achieved was 122.5 ft.

Analysis Information

Analyst : E. Larsen

Data Processing Reference : MAC-VZCP 1.7.9 Analysis Date : 11/02/1998

Analysis Notes :

The pre-survey and post-survey field verification for each logging run met the acceptance criteria established for peak shape and system efficiency. The energy calibration and peak-shape calibration from the accepted calibration spectrum that most closely matched the field data were used to establish the peak resolution and channel-to-energy parameters used in processing the spectra acquired during the logging operation.

This borehole was completed with 4-in.- and 6-in.-diameter casings along the entire logged interval. A casing correction factor for a 0.50-in.-thick steel casing was applied to the concentration data because it most closely matched the 0.517-in. total combined thickness of the 4-in. and 6-in. casings. The entire annulus between the 4-in. and 6-in. casings is likely filled with grout, making it impossible to produce accurate radionuclide assays. However, man-made and natural radionuclides were identified and apparent concentrations are reported.

Approximately 0.9 ft of water has collected inside the bottom of this borehole. The appropriate water correction factor was not available, so no compensation was applied, resulting in lower reported man-made and natural radionuclide concentration values along the water-filled interval.

Log Plot Notes:

Separate log plots show the man-made and the naturally occurring radionuclides. The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations. Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

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Log Event A

A combination plot includes the man-made and natural radionuclides, the total gamma derived from the spectral data, and the Tank Farms gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

The interval between 40 and 55 ft was relogged as a quality assurance measure to establish the repeatability of the radionuclide concentration measurements made by the SGLS at that time. The radionuclide concentrations were calculated using separate data sets provided by the original and rerun logging runs. A comparison of the two data sets are shown on individual log plots.

A time-sequence plot of historical gross gamma-ray data collected between 1975 and 1994 is presented.

Results/Interpretations:

The radionuclide concentrations identified in this section are reported as apparent concentrations only and are underestimated.

The man-made radionuclides Cs-137, Co-60, Eu-154, and Eu-152 were detected by the SGLS. The Cs-137 contamination was detected nearly continuously from the ground surface to a depth of 6 ft. A single occurrence of Cs-137 was detected at 29 ft.

The Co-60 contamination was measured nearly continuously from 41.5 to 63.5 ft and continuously from 76 to 81 ft. Isolated occurrences of Co-60 contamination were detected at 68 ft, from 71 to 71.5 ft, and at 84 and 112.5 ft.

The Eu-154 contamination was measured continuously from 41.5 to 59.5 ft. A small zone of nearly continuous Eu-154 was detected from 77 to 79 ft. Single occurrences of Eu-154 contamination were detected at 71 and 107.5 ft.

The Eu-152 contamination was detected from 42.5 to 43 ft and 46.5 to 48.5 ft.

The K-40 concentrations increase from about 37 to 40 ft and remain elevated to a depth of about 50 ft. Increased Th-232 concentrations occur from 80 to 91 ft. Sharply decreased K-40 concentrations and slightly decreased Th-232 concentrations occur from 90.5 to 96 ft and 100 to 105 ft. A sharp peak in the U-238 concentrations was detected at 102.5 ft. The K-40 and Th-232 concentration values increase from about 107.5 to 110.5 ft and generally remain elevated to the bottom of the logged interval.

Additional information and interpretations of log data are included in the main body of the Tank Summary Data Report for tank T-103.